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**APPLICATION FOR UNITED STATES LETTERS PATENT**

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**Title: NO VOC SOLVENT BLEND**

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**Specification**

## **NO VOC SOLVENT BLEND**

### **BACKGROUND OF THE INVENTION**

Due to government regulations and environmental concerns, the use of volatile organic compounds must be reduced. It is desirable to provide cleaning agents that do not contain volatile organic compounds. A volatile organic compound is defined as one which has a vapor pressure equal to or greater than 0.1 mm Hg at 20° C.

It is, however, very difficult to provide an effective cleaning solvent that contains no volatile organic compounds.

### **SUMMARY OF THE INVENTION**

The present invention is premised on the realization that a solvent blend which effectively dissolves grease and oil includes a major portion of a petroleum distillate having a vapor pressure less than 0.1 mm Hg in combination with a glycol ether soluble in the petroleum distillate and also

having a vapor pressure of less than 0.1 mm Hg combined with a third component. The third component is a low molecular weight ester, soluble at room temperature and likewise having a vapor pressure of less than 0.1 mm Hg.

5                    More particularly, the present invention is premised on the realization that a solvent blend having a combination of 30% to 60% by weight of light petroleum distillate, preferably hydrotreated light petroleum distillate, in combination with 20% to 50% by weight of a glycol ether and at least 10% of a C<sub>1</sub>-C<sub>4</sub> ester having a chain length of less than 15 and a  
10                    vapor pressure of less than 0.1 mm Hg effectively dissolves grease and oil.

                    The object and advantages of the present invention will be further appreciated in light of the following detailed description.

#### **DETAILED DESCRIPTION OF THE INVENTION**

                    The present invention is a blend of three separate solvents  
15                    which effectively remove grease and oil, and which has no volatile organic compounds. The composition includes a petroleum distillate, a glycol ether and a ester solvent.

                    The composition will include 30-60% by weight of a petroleum distillate. In particular, the petroleum distillate should be a light petroleum  
20                    distillate and, more particularly, a hydro treated petroleum distillate.

                    Hydrotreated light petroleum distillates have a carbon number ranging from 9 to 16 and a boiling temperature range from 150° to 290° C. The hydro treatment simply saturates the olefin by adding hydrogen. One

preferred hydrotreated light petroleum distillate is sold by Exxon under the name Exxsol D-110 which has a vapor pressure of less than 0.1 mm Hg at 20° C. Other similar light petroleum distillates having a vapor pressure less than 0.1 mm Hg will also function in the present invention.

5                   The second component of the present invention is a glycol ether solvent, again having a vapor pressure of less than 0.1 mm Hg at 20° C. There are a wide range of commercially available glycol ethers. Specific examples include propylene glycol n-butyl ether, propylene glycol n-propyl ether, diethylene glycol monobutyl ether, ethylene glycol monobutyl ether,  
10   dipropylene glycol methyl ether, tripropylene glycol methyl ether, dipropylene glycol n-propyl ether, dipropylene glycol mono n-butyl ether, tripropylene glycol mono n-butyl ether, propylene glycolphenyl ether and propylene glycol n-butyl ether.

                  Preferred glycol ethers include dipropylene glycol n-butyl ether  
15   (Dowenol DpNB), tripropylene glycol n-butyl ether (Dowenol TpNB), tripropylene glycol methyl ether (Dowenol TPM), and propylene glycol phenyl ether (Dowenol PPh). As indicated, these can be used in an amount from 20 to 50% by weight of the solvent blend with about 30% being preferred.

                  The third component of the solvent blend of the present  
20   invention will be at least 10% of an ester solvent. The ester solvent will have a vapor pressure less than 0.1 mm Hg at 20° C. Generally, these will be a C<sub>1</sub>-C<sub>4</sub> alkyl ester or diester having a fatty acid carbon chain length of less than about 18. Blends of these esters can also be employed.

Suitable esters include methyl laurate, methyl myristate, methyl palmitate, 2-ethyl hexylactate, diisobutyl glutarate, diisobutyl adipate, diisobutyl succinate, dimethyl adipate, dimethyl glutarate, and dimethyl succinate.

5                   Commercially available blends of ester solvents include Edenor C1270 from Cognis, which includes a combination of primarily methyl laurate and methyl myristate and a small portion of methyl palmitate; PuraSolv EHL from Purac; DBE-IB from DuPont, which is a combination of diisobutyl esters of gluteric acid, adipic acid and succinic acid; DBE-3, which  
10 is a dimethyl ester of adipic acid in combination with gluteric acid; and finally DBE-5, which is 99% dimethyl glutarate with the remainder dimethyl succinate. As the ester solvent is generally the most expensive component of the present invention, its use is minimized. Therefore, the present invention should have at least 10% by weight of the ester solvent up to  
15 about 30%, again with 10% being preferred.

The solvent formulation of the present invention is formed by simply blending the individual components. No order of addition is required. Further, blending can be conducted at room temperature.

This solvent can be used to clean or remove hydrocarbon type  
20 soils, oils and greases from hard surfaces. It can also be used for degreasing parts and can be incorporated into aqueous cleaning solutions for floor scrubbing, spray and wipe, and pressure washing. If added to water, the concentration of the solvent blend should be 1 to 20% by weight.

The present invention will be further appreciated in light of the following detailed example.

**EXAMPLE 1**

A no VOC solvent blend was formed by combining 10%  
5 Edenor ME C1270 (ester solvent), 30% Dowenol DpNB (glycol ether), and 60% Exxsol D-110. This was compared under identical circumstances with d-limonene, butyl cellosolve, Edenor ME C1270 by itself, DuPont DBE-IB by itself, PuraSolv EHL by itself, Dowenol DpNB by itself, and Exxsol D-110 by itself.

10 To test the solvents and cleaning solutions, grease was placed on a test strip and weighed. The test strip was placed in the solvent or cleaning solution for 5 minutes, removed, rinsed, dried and re-weighed. The percentage of grease removed was calculated, and the results are shown in Table 1.

15 **Table 1**

<b>Solvent</b>	<b>% Grease Removed</b>
d-Limonene	90.5
Butyl Cellosolve	25.13
Edenor ME C1270	48.74
Dupont DBE-1B	61.87
PuraSolv EHL	69.53
Dowenol DpNB	67.64
Exxsol D-110	69.21
No VOC Solvent Blend	94.39

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## EXAMPLE 2

In order to test different esters, three test solutions were formed using 60% Exxsol D-110, 30% Downol DpNB, and 10% ester solvent. The ester solvents were Edenor ME C1270, DuPont DBE-IB (isobutyldibasic ester) and PuraSolv EHL (ethylhexylactate). These are labeled No VOC Solvent Blend A, B, or C, respectively, in Table 2. Using the test set forth in Example 1, these were compared with d-limonene, butyl cellosolve, DuPont DBE-IB, and PuraSolv EHL. As shown in Table 2, each of these was comparable or exceeded the performance of d-limonene and all exceeded the performance of butyl cellosolve.

Table 2

Solvent	% Grease Removed
d-Limonene	90.25
Butyl Cellosolve	25.13
Edenor ME C1270	48.74
No VOC Solvent Blend A	94.39
Dupont DBE-1B	61.87
No VOC Solvent Blend B	89.55
PuraSolv EHL	69.53
No VOC Solvent Blend C	95.82

## EXAMPLE 3

In order to test the efficacy of potential combinations of two of the three components of the present invention, 50:50 by weight mixtures of

Edenor and DpNB, Edenor and Exxsol D-110, and DpNB and Exxsol D-110 were formed. Each of these three blends were then tested for percent grease removal. The Edenor/DpNB blend removed 52.77%, the Edenor/Exxsol D-110 blend removed 60.1%, and the DpNB/Exxsol D-110  
5 blend removed 67.89%. Accordingly, this establishes that two of the three components by themselves do not perform as effectively as the three-component blend.

Thus, the three-component blend of the present invention including the hydro treated light petroleum distillate, the glycol ether and the  
10 ester solvent out performs commonly used solvents including d-limonene and butyl cellosolve. Further, the composition of the present invention contains no volatile organic compounds, whereas both d-limonene and butyl cellosolve are characterized as volatile organic compounds.

This has been a description of the present invention along with  
15 the preferred method of practicing the present invention. However, the invention itself should only be defined by the appended claims.

WHAT IS CLAIMED IS: